Human Spaceflight and American Society: The Record So Far—Charles Murray

These remarks give me an excuse to revisit a world that Catherine Cox and I had a chance to live in vicariously from 1986 to 1989 when we were researching and writing about Project Apollo. As I thought about it, I realized that actually very few people in this audience have had a chance to live in that world, either vicariously or for real. For most people today, NASA's human spaceflight program is the Shuttle. The NASA you know is an extremely large bureaucracy. The Apollo you know is a historical event.

So to kick off today's presentations, I want to be the "Voice of Christmas Past." If we want to think about what is possible for human spaceflight as part of America's future, it is essential to understand how NASA people understood "possible" during the Apollo era.

It is also important to understand that the way NASA functioned during the Apollo Program was wildly different from the way NASA functions now. In fact—and I say this with all due respect to the current NASA team members who are doing fine work—the race to the Moon was not really a race against the Russians; it was a race to see if we could get to the Moon before NASA became a bureaucracy, and we won. But the lessons of that experience should be ones that we still have at the front of our minds.

First, I would like to provide some perspective on time scale. Think back to 20 July 1990. This was the twenty-first anniversary of the first lunar landing, but that is not why I chose the date. From 20 July 1990 to May 2001 is the same amount of time as from the founding of NASA to the first Moon landing, only eleven years. If you think back to what you were doing on 20 July 1990, it just was not that long ago. So if we think about what infrastructure for human exploration of space existed in 1958, when NASA started, we realize there was virtually none. At that time, there were few buildings, a small staff, and not a glimmer of the equipment that Mercury, Gemini, and Apollo would use. At that time, the largest booster in the U.S. launcher inventory was the Redstone, which was less powerful than the escape tower on the Saturn V. The Space Task Group that was responsible for NASA's early human spaceflight efforts was formed only a few months after NASA itself.

Occasionally I am asked, "How can we get to Mars?" I am tempted to say, "Well, junk the current space program, go down to Langley Air Force Base, put together forty-five people that have no experience whatsoever, give them eleven years, and they will do it." Now that is facetious, but it is how short the period of time was between ground zero and the first Moon landing.

The speed is only symptomatic, however, of the way that NASA functioned during those early years, and I want to go over a few of those characteristics. The first was simply youth. Of the forty-five people who were initial members of the Space Task Group, Robert Gilruth was the oldest at forty-four. Joe Shea and George Low got their jobs at thirty-two and thirty-four, respectively. Chris Kraft got his first big job at the age of thirty-four. Glynn Lunney and Gene Kranz, lead flight directors during the big Apollo missions, became flight directors in their twenties, and they were still barely into their thirties when they were lead flight directors for the Apollo flights.

People were very young, and it made a difference. As you talk to the people of Apollo, they will say over and over, "We didn't know we couldn't do it." People who were older who would try to come into this business often were not able to cut it. The reason they could not cut it was that they were too aware of all the ways that things could go wrong.

One of the things that youth brings with it is an ability to form tightly knit teams, another characteristic of the early NASA. It was so small to begin with that everybody knew one another. Even though by the time Apollo flew, it had mushroomed into tens of thousands of people, those initial connections remained. There were people who had known each other at Langley Center and at Lewis Center who dealt with each other in ways that had nothing to do with their places in the organization charts.

Joe Bobek, who was a second-generation Polish immigrant with only a high school education but a genius mechanic, became chief inspector for the Apollo spacecraft. In contrast, George Low was the courtly offspring of an affluent Austrian family, a brilliant engineer, and exceedingly well educated. Before every Apollo flight, George Low would take a sandwich down to the pad and sit down with his old mechanic buddy from Lewis Research Center. They would talk about what George Low needed to know about that spacecraft.

You had people such as Joe Shea and George Low taking demotions all the time during the Apollo Program. They were sent out of Washington to the Centers. They were technically far lower on the ladder than they had been before, but the reason they did that was because that was where the action was.

I do not want you to feel that I am completely unrealistic and starry-eyed about Apollo. Were there any people who were mostly concerned about their careers during Apollo? Of course there were. But if you talked to a lot of people from Apollo, you also got a very clear message with lots of evidence that this was the period of their life when their personal careers really weren't nearly as important as focusing on the job at hand.

People were calling back and forth, ignoring lines of hierarchy in their quest to solve problems. Incredibly brilliant engineers were running the program. People such as George Mueller, who was in charge of human spaceflight at Headquarters, were extremely well-versed in virtually all details of their programs. In terms of engineering, Mueller could wrestle to the ground a relatively low-level engineer on his own particular specialty. The same thing could be said again and again for people such as Shea, Low, Max Faget, and all the rest. They were managers, yes, but they knew just about everything there was to know about the systems they were dealing with, and this made a lot of difference when they wanted to obtain the respect and the overtime work and the commitment of the troops.

Another important aspect of the program, which you can get away with more easily when it's a young program, was its incredible audacity. I shall give you three examples.

The first example goes back to George Mueller in 1963. He came into NASA as head of human spaceflight and set his underlings to work on a comprehensive look at the schedule and how it was going. They were not going to get to the Moon before 1970 or 1971; that was absolutely clear. So what did George Mueller do? He imposed on the Centers all-up testing. This meant that the first flight of the Saturn rocket, with its mammoth 7.5 million pounds of thrust in the first stage alone, would be with all three stages in that stack. All three stages were untested when Mueller made this decision. This approach was anathema to the German rocket team down at Marshall. The Germans had done very well by testing incrementally, one piece at a time.

The engineers from Langley had done very well taking their experimental aircraft over the years and testing them out one step at a time. Here was this guy from the ICBM world, the third culture, as it were, that made up NASA in those days, telling them, "We're going to do all-up testing—we're going to do it all at one time." No committees made that decision. George Mueller made that decision. It was not a political decision. He was not doing it just to get to the Moon before 1970, although that was clearly one of the motivations for it. But the engineering logic behind it was absolutely fascinating. I recommend you look at this decision-making process as a case study of rigorous engineering thinking combined with enormous willingness to do what was necessary to get a job done.

The second case of audacity was George Low's decision to make Apollo 8 a circumlunar mission. Again, in reconstructing how it was done and why it was done, we are not talking about some wild-eyed adventure. There were engineering reasons why it was possible and why it was not only possible, but valuable. But it was the kind of decision which pushed everything in the schedule a quantum leap ahead of where it would have been otherwise.

The third case of audacity is not a particular event; it is the years that Joe Shea was the head of the Apollo Spacecraft Program Office. It has been Joe Shea's legacy to be remembered as the guy who was pushing so hard that mistakes were not caught, and we had the 1967 fire that killed three astronauts. This was a very controversial period in NASA history, and Joe Shea certainly took the fall for the accident. Nobody was tougher on Joe Shea than Joe Shea was on himself.

I submit to you that he was doing exactly the same thing that George Mueller and George Low were doing. But the coin came up tails for him. But if it had come up tails for George Low in Apollo 8, people would have said, "What on Earth are you doing trying to send the second manned flight of an Apollo spacecraft around the Moon?" If the first flight of the Saturn V on the all-up had failed, people would have said, "Well, that was really dumb to try to test all three stages at once." The first time it had ever been done, everybody told him he should not do it, and look what happened.

The Apollo Program was audacious, and occasionally it failed. But the only reason we had a spacecraft as mature as the one we had in 1967 was because Joe Shea had been operating that way for four years and accomplishing wonderful things by so doing.

In trying to pull together my thoughts about the way NASA operated, I would like to suggest considering the Apollo 12 mission. I recommend that NASA have a three-day seminar for senior management staff on Apollo 12, meditating on it as a fascinating example of managing a space program. As some may recall, Apollo 12 was hit by lightning. It was actually hit by lightning twice in the boost phase of the first stage, knocking everything onboard to flinders. All the warning lights went on. Down on the ground, it wasn't that all the data had been lost on

Shortly after liftoff on 14 November 1969, lightning struck the Apollo 12 Saturn V launch vehicle and the launch tower. NASA Image KSC-69PC-812. Special thanks to Kipp Teague for help with this image.

the controllers' screens, but that the data made no sense whatsoever. They didn't know that the spacecraft had been hit by lightning. All the controllers knew was that the platform had been lost; the guidance platform had been lost; that they weren't able to read any of their data; and it was taken for granted that what you had to do at that point was abort.

Here is the first vignette from that Apollo 12 launch. Sitting at one of the mission control consoles was one John Aaron. He later rose to great heights in NASA, but at that time he was only twenty-five or twenty-six years old. A year earlier, he had been sitting in the control room at Houston watching a test at the Cape, which they often did just to get to understand their systems better.

This particular time, at some point during the test, his screen suddenly turned to weird numbers. Incidentally, the screens of the Apollo controllers did not have nice graphics on them. They were black screens. They had fuzzy white numbers, [with] columns of fuzzy white numbers on them at that time. That's all the controllers viewed. The numbers were constantly changing. Incidentally, it is also true that the numbers were not in real time because the computers were quite slow. So controllers had to factor in that some of the numbers that were changing were 15 seconds old, while other numbers were 10 seconds old and so forth. That is the kind of thing you did if you were an Apollo controller.

Technicians in the Firing Room listen to Apollo 12 and Mission Control overcome lightning-induced electrical problems. NASA Image KSC-69P-856. Special thanks to Kipp Teague for help with this image.

Aaron had looked into things, called up the Cape, and finally managed to figure out what was going on. He was told of an obscure board, called the signal conditioning equipment, SCE, that would have restored their numbers if it was switched to auxiliary mode. This was something that John Aaron had done that was not a formal part of his job. It was part of hundreds of similar experiences he'd had. This was not something that the controllers had practiced in any simulation since then. He was probably one of the only people in all of NASA who knew this thing existed. In the critical launch phase, when they were about to lose a crew, when everything was going crazy, Aaron looked at that screen, and he understood within a matter of seconds what was going on.

On the Apollo 12, the spacecraft had been hit by lightning twice in the initial ascent phase. Controllers had lost the platform but managed to reset it. They had a couple of hours in which to go through tests of the spacecraft, and then they had to decide whether to go forward with translunar injection.

Catherine Cox and I really wanted to reconstruct the decision that was being made by Rocco Petrone, Chris Kraft, Jim McDivett, and the other senior people who were in charge of that flight. We talked to all of them, and we couldn't get a story out of it because here's what happened. These twenty-six-, twenty-seven-, twenty-eight-, twenty-nine-year-old controllers went through all the systems down there in the control room. Then they turned around to the back row and said, "We've got a clean spacecraft; let's go," and there was no fretting about it.

When I was interviewing Gene Kranz once, I asked him, "Gee, this seems to me like a very dicey thing to do. Yes, you've checked out the spacecraft, but, after all, the thing has been hit by a huge bolt of lightning through all its electronics." Kranz was very matter-of-fact about it—"No, you go the way the data leads you." So I finally asked him "if a similar thing happened with the Space Shuttle and you had to make the equivalent of a decision to go out of Earth orbit, would you do the same thing?" Gene Kranz was not often at a loss for an answer, but he just sat and stared at me for about five seconds, and then he broke into a laugh, and he didn't say anything.

That was the way that that mission worked. It was a story of everything that made the human spaceflight program such a wonderful adventure, as well as an excellent case study from which later people could learn.

I second the remarks of Administrator Goldin about the future of human spaceflight. I think that his aspirations for it are just right. The only thing I would add is that if it is to succeed, human spaceflight must most of all capture the public imagination.

Part of the reason for that is hardheaded politics; you can't have a big program unless you have gotten the political funding for it, and the political funding only comes for it if you have captured a large part of the public imagination.

The essence of human spaceflight is that it does great things. That is how it captures the public imagination. About 600 years ago, with the invention of the scientific method, the deep abiding human impulse to understand and to explore, which previously had been confined to philosophy and religion, was let loose on all the other ways that we could explore the world. Now, in the twentieth century, I think that human spaceflight touches the wellspring of the human spirit and excites a great many people. Human spaceflight also represents the great next adventure in that continuing quest to understand and to explore—only this time it is to understand and explore the universe.

We are never going to get a majority of the American people to share in that aspiration any more than you could get 51 percent of the people in Europe who wanted to get in small dangerous boats and go to the new world. There always will be objections such as "We would be better off spending money to combat poverty here on Earth." There is, however, a sizable minority who has a lot of influence, and they can be energized. But the only way that they can be energized is if human spaceflight remains true to its mission—it must do something beyond building one brick after another. It must continue to push the envelope with audacity, by going [to] new places, by doing new things, by taking on grand missions.

So as somebody who doesn't have a technical background and doesn't work for NASA, I'll go ahead and give some advice anyway. Get a grand mission, believe in it, give it to a new generation, and get the hell out of the way. Thank you very much.